查询RT9002A供应商

Dual Low-Dropout Regulator with Detector

General Description

The RT9002A/B/C is a dual-channel, low noise, and low dropout regulator. The first regulator is capable of sourcing 240mA, while the second regulator can source up to 500mA and includes a voltage detection function. The RT9002A/B/C performance is optimized for CD/DVD-ROM, CD/RW or wireless communication supply applications. The RT9002A/B/C regulator is stable with output capacitors as low as 1μF. The other features include high output accuracy, ultra-fast transient response, tight load and line regulation, current limiting/thermal protection and high ripple rejection ratio. The RT9002A/B/C is available in SOP-8 package requiring minimum board space and smallest components.

Features

- **Low Quiescent Current (Typically 70μA)**
- **Wide Operating Voltage Ranges : 2.5V to 5.5V**
- **Ultra-Fast Transient Response**
- **Tight Load and Line Regulation**
- **Current Limiting Protection**
- **Thermal Shutdown Protection**
- **Only low-ESR Ceramic Capacitors Required for Stability**
- **Custom LDO V_{OUT1}, V_{OUT2} Voltage Available from 1.5V to 3.3V**
- **Custom V_{IN} Detector Available from 3.5V to 4.0V**
- **RoHS Compliant and 100% Lead (Pb)-Free**

Ordering Information

RT9002A/B/C - □□

- Package Type
  S : SOP-8
- Operating Temperature Range
  P : Pb Free with Commercial Standard
  G : Green (Halogen Free with Commercial Standard)
- Output Voltage : VOUT1/VOUT2
  A : 2.5V/3.3V
  B : 1.5V/2.8V
  C : 2.5V/3.3V

Note :

RichTek Pb-free and Green products are :

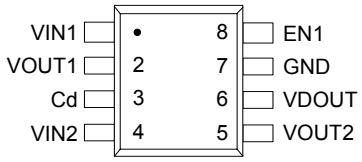
- RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
- Suitable for use in SnPb or Pb-free soldering processes.
- 100% matte tin (Sn) plating.

Applications

- CD/DVD-ROM, CD/RW
- Wireless LAN Card/Keyboard/Mouse
- Battery-Powered Equipment
- XDSL Router

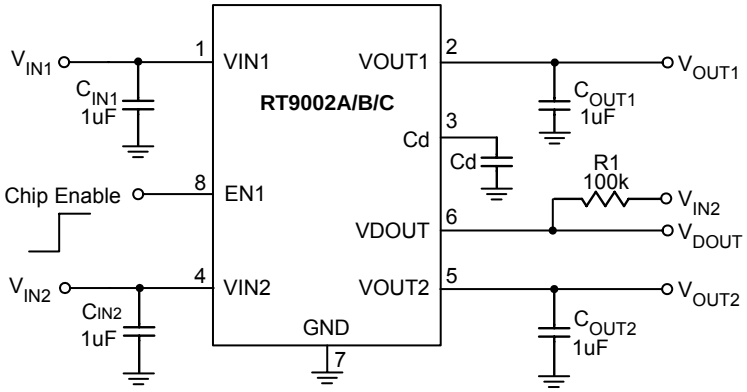
Pin Configurations

(TOP VIEW)



SOP-8

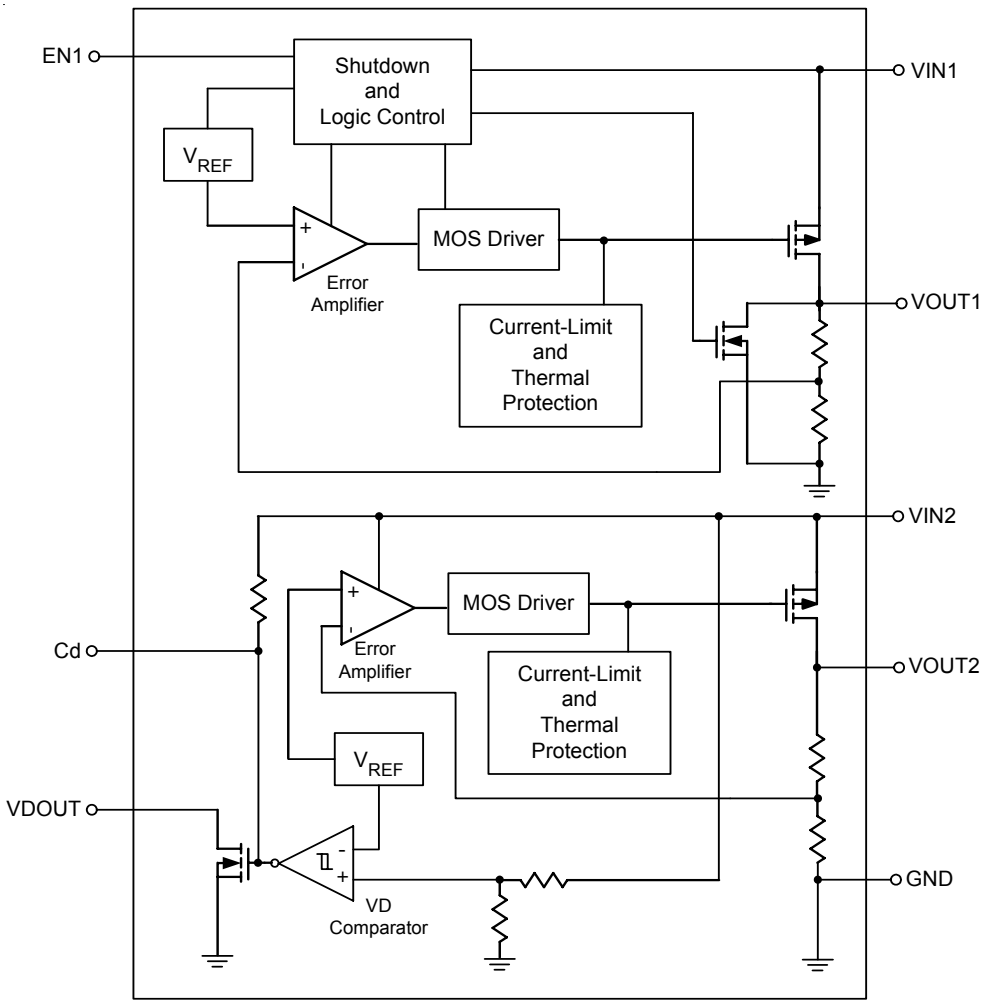
Typical Application Circuit



Functional Pin Description

Pin No.	Pin Name	Pin Function
1	VIN1	Channel 1 Supply Input.
2	VOUT1	Channel 1 Output Voltage.
3	Cd	Delay Capacitor.
4	VIN2	Channel 2 Supply Voltage.
5	VOUT2	Channel 2 Output Input.
6	VDOUT	Detector Output Voltage. (RT9002A = Active High, RT9002B and RT9002C = Active Low)
7	GND	Common Ground.
8	EN1	Chip Enable (Active High) for Channel 1.

Function Block Diagram



Absolute Maximum Ratings (Note 1)

- Supply Input Voltage ---------- 6V
- Package Thermal Resistance (Note 4)
  SOP-8, θ_{JA} ---------- 110°C/W
- Power Dissipation, P_D @ T_A = 25°C
  SOP-8 ---------- 0.909W
- Lead Temperature (Soldering, 10 sec.) ---------- 260°C
- Junction Temperature ---------- 150°C
- Storage Temperature Range ---------- –65°C to 150°C
- ESD Susceptibility (Note 2)
  HBM (Human Body Mode) ---------- 2kV
  MM (Machine Mode) ---------- 200V

Recommended Operating Conditions (Note 3)

- Supply Input Voltage ---------- 2.5V to 5.5V
- Chip Enable Input Voltage ---------- 0V to 5.5V
- Junction Temperature Range ---------- –40°C to 125°C
- Ambient Temperature Range ---------- –40°C to 125°C

Electrical Characteristics

(V_{IN} = V_{OUT} + 1V, whichever is greater, C_{IN} = 1µF, C_{OUT} = 1µF, T_A = 25°C, unless otherwise specified)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Units
Regulator 1							
Output Voltage Accuracy	RT9002A	ΔV_{OUT1}	I_{OUT1} = 30mA	2.45	2.50	2.55	V
	RT9002B			1.47	1.50	1.53	
	RT9002C			2.45	2.50	2.55	
Maximum Output Current		I_{OUT1_MAX}		240	--	--	mA
Load Regulation (Note 5)		ΔV_{LOAD1}	1mA < I_{OUT1} < 100mA	--	1	--	mV
Dropout Voltage (Note 6)		V_{DROP1_1}	I_{OUT1} = 30mA	--	50	--	mV
		V_{DROP1_2}	I_{OUT1} = 100mA	--	150	--	
Quiescent Current (Note 7)		I_{Q1}	V_{IN1} = V_{EN1} = 3.5V, I_{OUT1} = 0mA	--	30	--	µA
Standby Current		I_{STB1}	V_{IN1} = 3.5V, V_{EN1} = 0V	--	0.1	1	µA
Line Regulation		ΔV_{LINE1}	V_{IN1} = 3.5V to 5.5V, V_{IN1} = V_{EN1}, I_{OUT1} = 30mA	--	0.01	0.2	%/V
Power Supply Rejection Rate		PSRR1	f = 100Hz, I_{OUT1} = 100mA	--	–60	--	dB
Current Limit		I_{LIM1}	V_{IN1} = V_{EN1} = 5V	--	450	--	mA
EN Threshold	Logic-Low Voltage	V_{IL}		--	--	0.6	V
	Logic-High Voltage	V_{IH}		1.8	--	--	
Thermal Shutdown Protection		T_{SD1}		--	170	--	°C

To be continued

Parameter		Symbol	Test Conditions	Min	Typ	Max	Units
Thermal Shutdown Hysteresis		ΔT_{SD1}		--	40	--	°C
Enable Pin Current		I_{EN}	V_{IN} = 3.5V, Enable	--	0.1	1	μA
Regulator 2							
Output Voltage Accuracy	RT9002A	ΔV_{OUT2}	I_{OUT2} = 30mA	3.234	3.30	3.366	V
	RT9002B			2.744	2.80	2.856	
	RT9002C			3.234	3.30	3.366	
Maximum Output Current		I_{OUT2_MAX}		500	--	--	mA
Load Regulation (Note 5)		ΔV_{LOAD2}	1mA < I_{OUT2} < 100mA	--	15	50	mV
Dropout Voltage (Note 6)		V_{DROP2_1}	I_{OUT2} = 30mA	--	50	90	mV
		V_{DROP2_2}	I_{OUT2} = 100mA	--	150	200	
Quiescent Current (Note 7)		I_{Q2}	V_{IN2} = 4.3V, I_{OUT2} = 0mA	--	40	--	μA
Line Regulation		ΔV_{LINE2}	V_{IN2} = 4.3V to 5.5V, I_{OUT2} = 30mA	--	0.01	0.2	%/V
Power Supply Rejection Rate		PSRR2	f = 100Hz, I_{OUT2} = 100mA	--	−60	--	dB
Current Limit		I_{LIM2}	V_{IN2} = 5V	--	800	--	mA
Thermal Shutdown Protection		T_{SD2}		--	170	--	°C
Thermal Shutdown Hysteresis		ΔT_{SD2}		--	40	--	°C
Detector							
Detect Fall Voltage	RT9002A	V_{DF}		3.528	3.60	3.672	V
	RT9002B			3.822	3.9	3.978	
	RT9002C			3.528	3.60	3.672	
Hysteresis		ΔV_{HYS}		V_{DF} x0.02	V_{DF} x0.05	V_{DF} x0.08	V
Sink Current	RT9002A	I_{DOUT}	V_{DOUT} = 0.5V, V_{IN2} = 5.0V	7.0	12.0	--	mA
	RT9002B		V_{DOUT} = 0.5V, V_{IN2} = 2.0V	4.0	8.0	--	
	RT9002C			4.0	8.0	--	

Note 1. Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2. Devices are ESD sensitive. Handling precaution recommended.

Note 3. The device is not guaranteed to function outside its operating conditions.

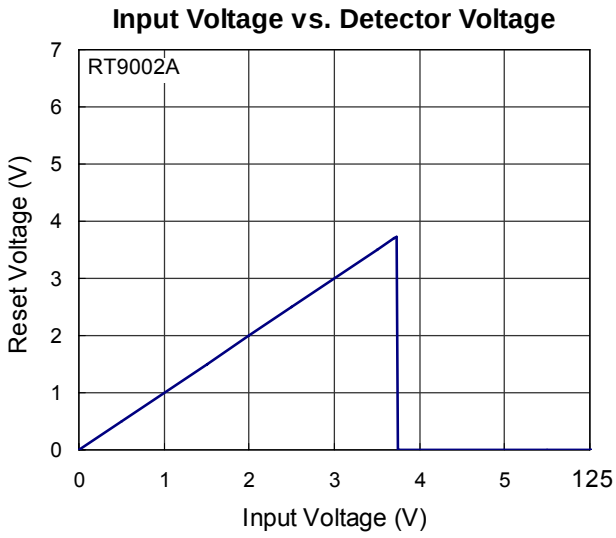
Note 4. θ_{JA} is measured in the natural convection at T_A = 25°C on a high effective thermal conductivity test board of JEDEC 51-7 2S2P 4-layer thermal measurement standard.

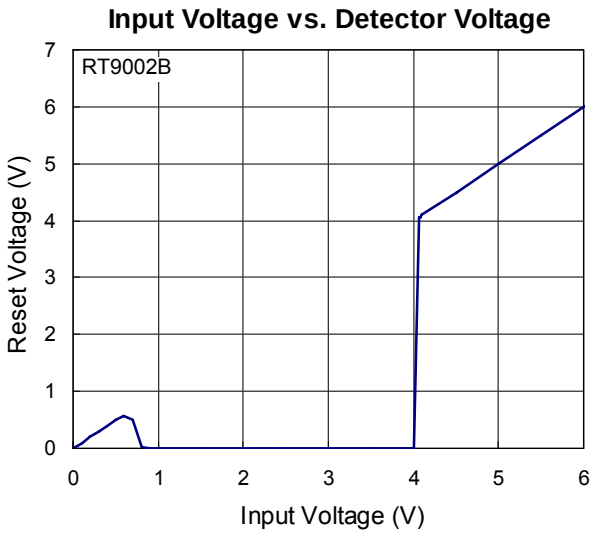
Note 5. Regulation is measured at constant junction temperature by using a 20ms current pulse. Devices are tested for load regulation in the load range from 1mA to 100mA.

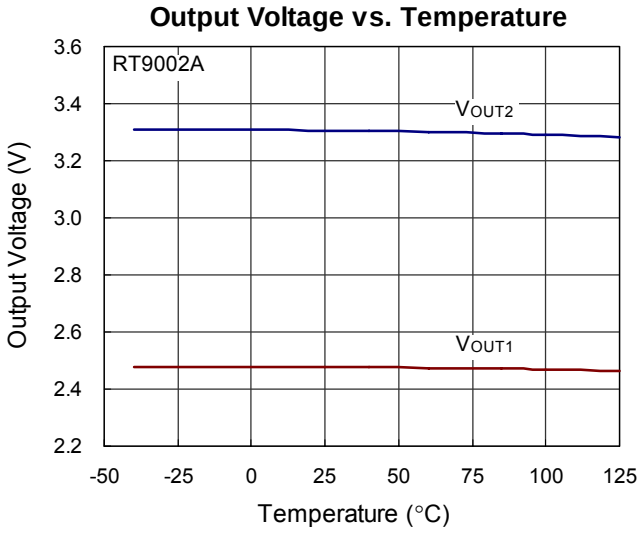
Note 6. The dropout voltage is defined as V_{IN} -V_{OUT}, which is measured when V_{OUT} is $V_{OUT(NORMAL)}$ – 100mV.

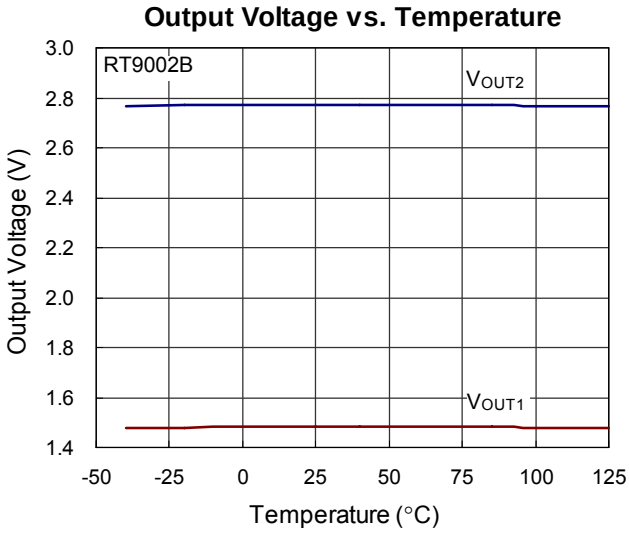
Note 7. Quiescent, or ground current, is the difference between input and output currents. It is defined by $I_Q = I_{IN} - I_{OUT}$ under no load condition (I_{OUT} = 0mA). The total current drawn from the supply is the sum of the load current plus the ground pin current.

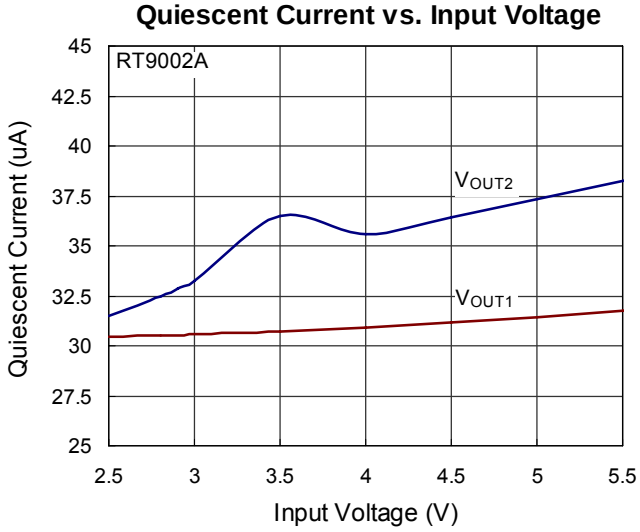
Typical Operating Characteristics

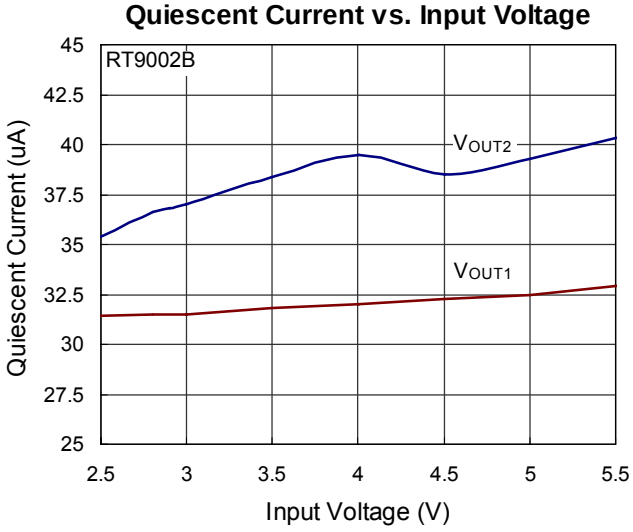


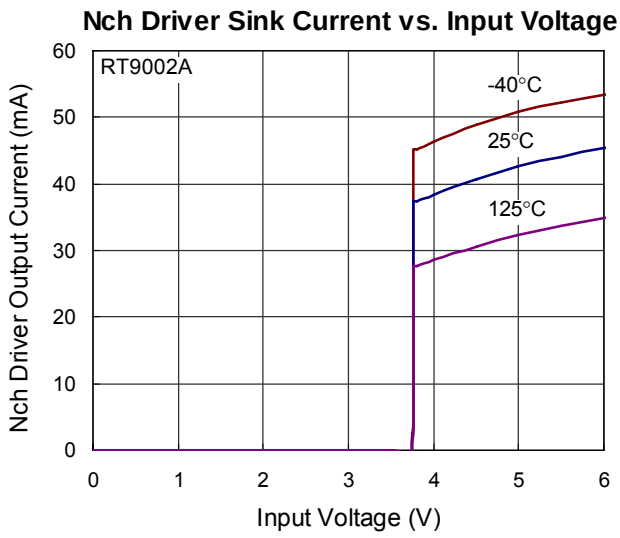


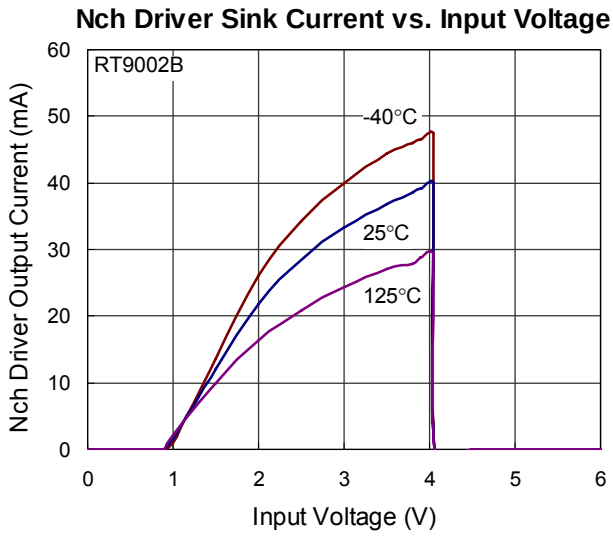


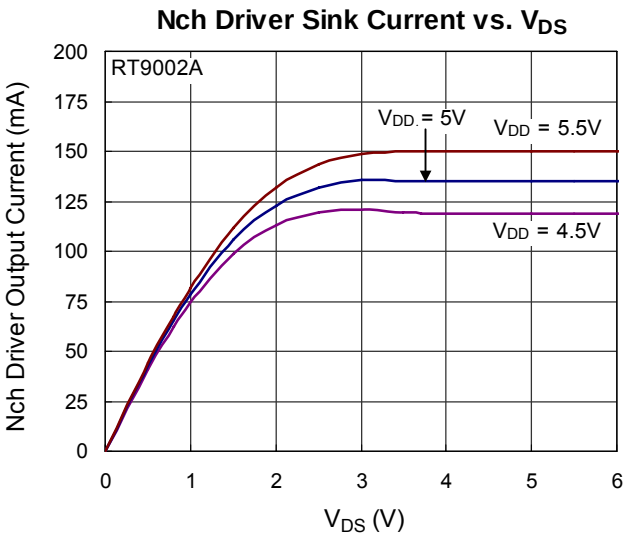


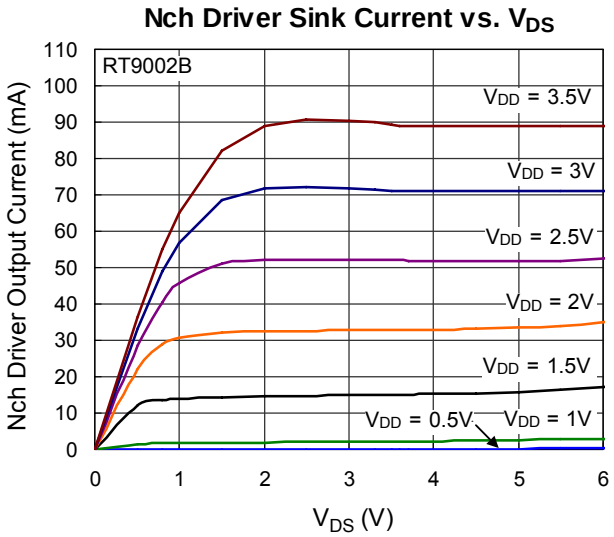


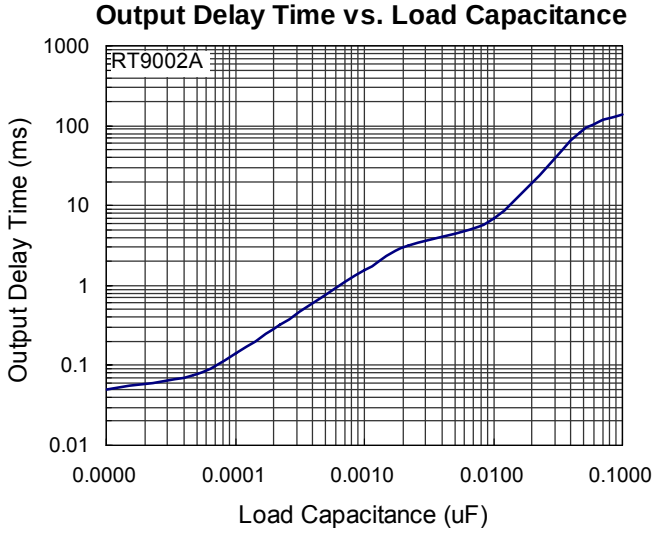


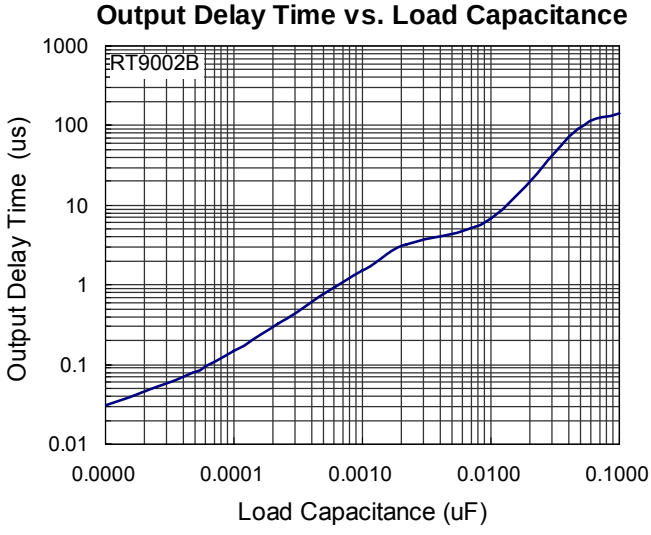

Nch Driver Sink Current vs. Input Voltage
RT9002A
-40°C
25°C
125°C
Nch Driver Output Current (mA)
Input Voltage (V)


Nch Driver Sink Current vs. Input Voltage
RT9002B
-40°C
25°C
125°C
Nch Driver Output Current (mA)
Input Voltage (V)

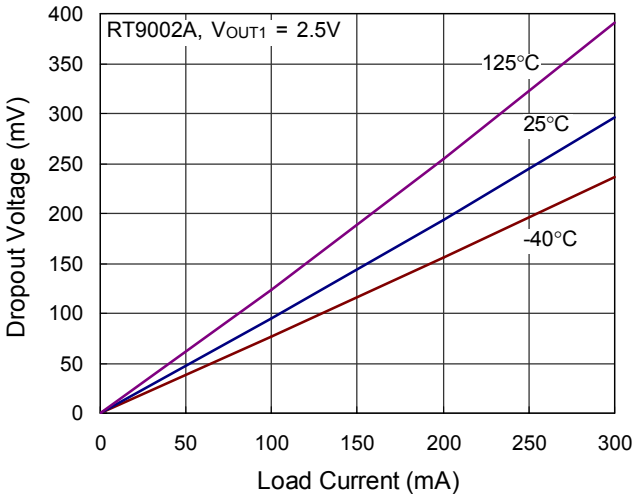

Nch Driver Sink Current vs. VDS
RT9002A
VDD = 5V
VDD = 5.5V
VDD = 4.5V
Nch Driver Output Current (mA)
VDS (V)


Nch Driver Sink Current vs. VDS
RT9002B
VDD = 3.5V
VDD = 3V
VDD = 2.5V
VDD = 2V
VDD = 1.5V
VDD = 1V
VDD = 0.5V
Nch Driver Output Current (mA)
VDS (V)

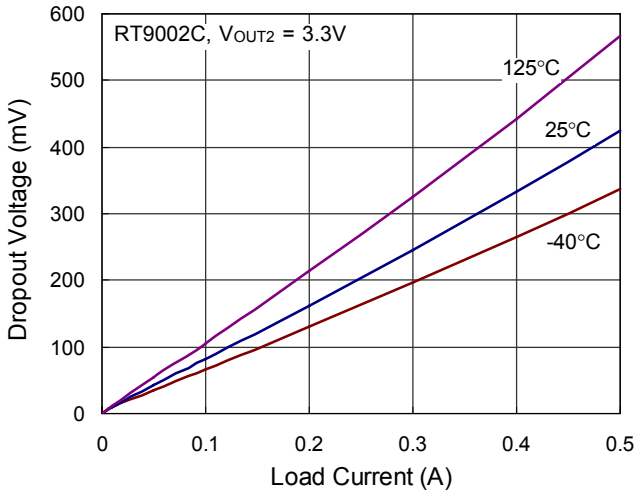

Output Delay Time vs. Load Capacitance
RT9002A
Output Delay Time (ms)
Load Capacitance (uF)


Output Delay Time vs. Load Capacitance
RT9002B
Output Delay Time (us)
Load Capacitance (uF)

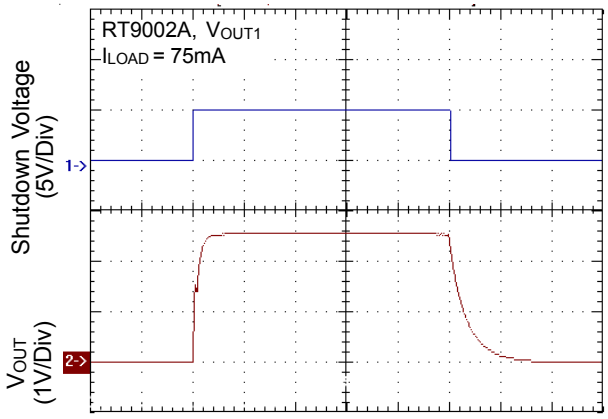
Dropout Voltage vs. Load Current



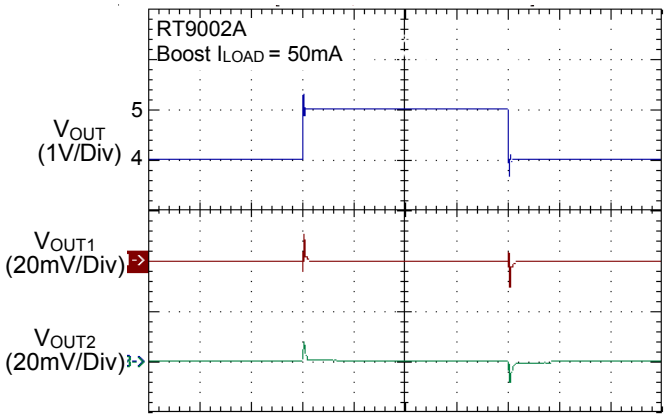
Dropout Voltage vs. Load Current



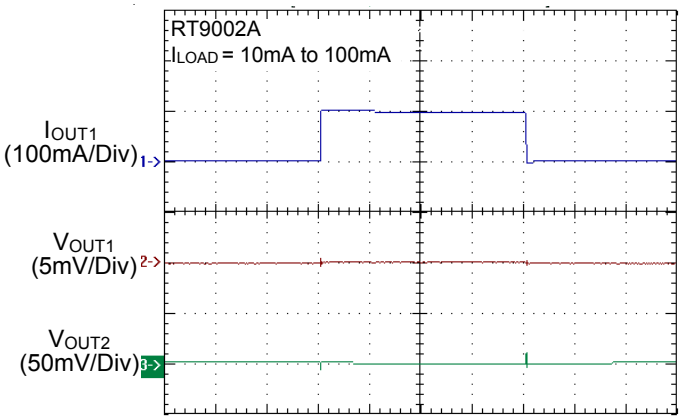
EN Pin Shutdown Response



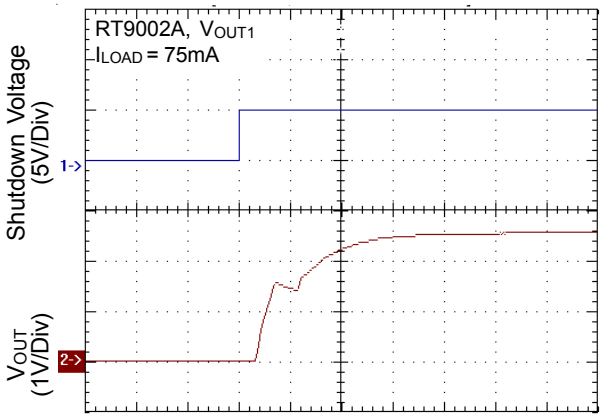
Line Transient Response

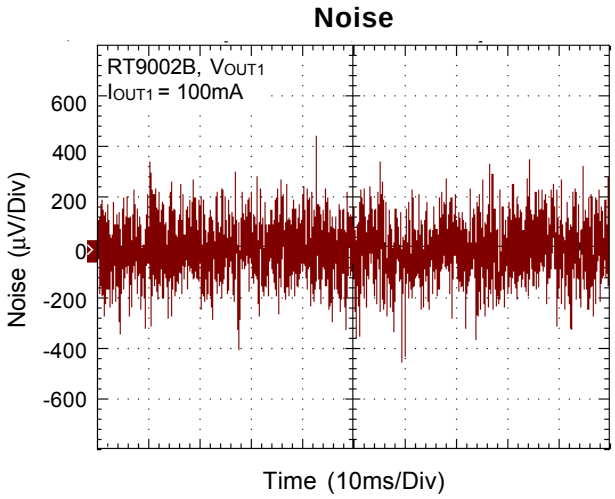


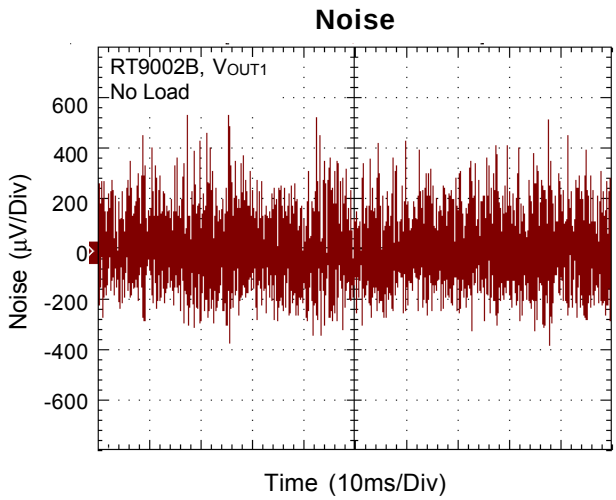
Load Transient Response



Start Up




Noise
RT9002B, VOUT1
IOUT1 = 100mA
600
400
200
0
-200
-400
-600
Noise (μV/Div)
Time (10ms/Div)


Noise
RT9002B, VOUT1
No Load
600
400
200
0
-200
-400
-600
Noise (μV/Div)
Time (10ms/Div)

Applications Information

Like any low-dropout regulator, the external capacitors used with the RT9002A/B/C must be carefully selected for regulator stability and performance. Using a capacitor whose value is > 1μF on the RT9002A/B/C input and the amount of capacitance can be increased without limit. The input capacitor must be located a distance of not more than 0.5 inch from the input pin of the IC and returned to a clean analog ground. Any good quality ceramic can be used for this capacitor. The capacitor with larger value and lower ESR (equivalent series resistance) provides better PSRR and line-transient response.

The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all LDOs application. The RT9002A/B/C is designed specifically to work with low ESR ceramic output capacitor in space-saving and performance consideration. Using a ceramic capacitor whose value is at least 1μF with ESR is > 20mΩ on the RT9002A/B/C output ensures stability. The RT9002A/B/C still works well with output capacitor of other types due to the wide stable ESR range. Figure 1. shows the curves of allowable ESR range as a function of load current for various output capacitor values. Output capacitor of larger capacitance can reduce noise and improve load transient response, stability, and PSRR. The output capacitor should be located not more than 0.5 inch from the VOUT pin of the RT9002A/B/C and returned to a clean analog ground.

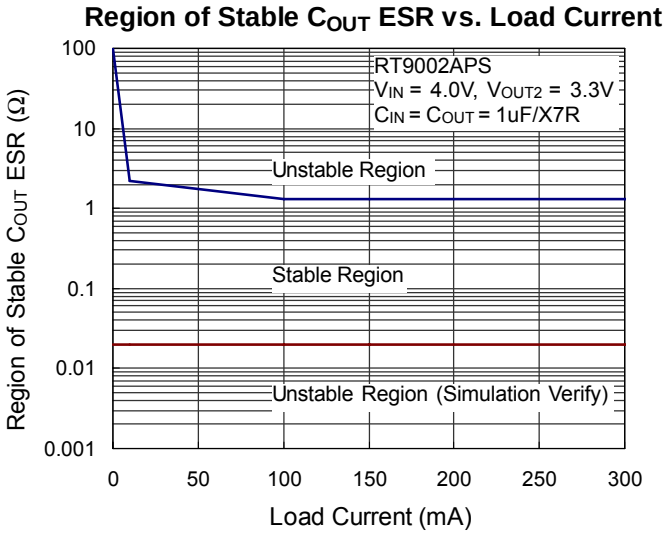


Figure 1

Enable

The RT9002A/B/C goes into sleep mode when the Enable pin is in a logic low condition. During this condition, the pass transistor, error amplifier, and bandgap are turned off, reducing the supply current to 0.1μA typical. The Enable pin may be directly tied to V_{IN} to keep the part on. The Enable input is CMOS logic and cannot be left floating.

PSRR

The power supply rejection ratio (PSRR) is defined as the gain from the input to output divided by the gain from the supply to the output. The PSRR is found to be

$$PSRR = 20 \times \log\left(\frac{\Delta \text{Gain Error}}{\Delta \text{Supply}}\right)$$

Note that when heavy load measuring, Δsupply will cause Δtemperature. And Δtemperature will cause Δoutput voltage. So the heavy load PSRR measuring is include temperature effect.

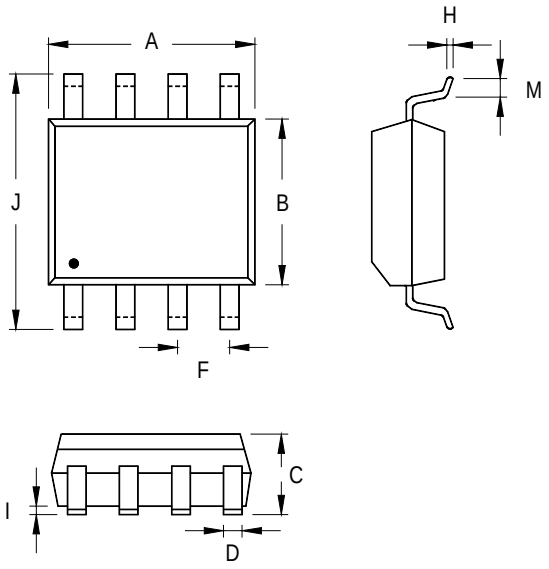
Current Limit

The RT9002A/B/C contains an independent current limiter, which monitors and controls the pass transistor's gate voltage, limiting the output1/2 current to 0.45/0.8A (typ.). The output can be shorted to ground indefinitely without damaging the part.

Thermal-Shutdown Protection

Thermal-shutdown protection limits total power dissipation in the RT9002A/B/C. When the junction temperature exceeds T_J = +170°C, the thermal sensor signals the shutdown logic, turning off the pass transistor and allowing the IC to cool. The thermal sensor turns the pass transistor on again after the IC's junction temperature cools by 40°C, resulting in a pulsed output during continuous thermal overload conditions. Thermal-shutdown protection is designed to protect the RT9002A/B/C in the event of fault conditions. For continual operation, do not exceed the absolute maximum junction temperature rating of T_J = +125°C.

Outline Dimension



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.801	5.004	0.189	0.197
B	3.810	3.988	0.150	0.157
C	1.346	1.753	0.053	0.069
D	0.330	0.508	0.013	0.020
F	1.194	1.346	0.047	0.053
H	0.170	0.254	0.007	0.010
I	0.050	0.254	0.002	0.010
J	5.791	6.200	0.228	0.244
M	0.400	1.270	0.016	0.050

8-Lead SOP Plastic Package

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